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ESTIMATES OF LOBSTER HANDLING MORTALITY ASSOCIATED WITH THE NORTHWESTERN HAWAIIAN ISLANDS LOBSTER TRAP FISHERY

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ADMINISTRATIVE REPORT H-96-03

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Southwest Fisheries Science Center
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Estimates of Lobster Handling Mortality Associated with the Northwestern Hawaiian Islands Lobster Trap Fishery

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INTRODUCTION

Anecdotal evidence indicates that lobster sorting and handling practices in the Northwestern Hawaiian Islands (NWHI) commercial lobster fishery may subject decked lobsters to a high rate of physical injury and overexposure to high temperatures and desiccating conditions. Handling mortality represents only one portion of the total mortality resulting from the capture and discarding of lobsters in the NWHI fishery. Other components of the mortality; e.g., post-release predation, remain to be estimated.

This report summarizes the results of handling mortality studies for "sublegal" (< 50 mm tail width for spiny lobster and < 56 mm tail width for slipper lobster)[1] and berried spiny lobster (*Panulirus marginatus*) and slipper lobster (*Scyllarides squammosus*) conducted in the NWHI during the 1996 National Marine Fisheries Service's (NMFS) lobster assessment survey.

METHODS

Handling mortality studies for spiny lobster were conducted at Necker Island from June 21 to 26 and for slipper lobster at Maro Reef from July 4 to 11. These locations were chosen both because of their relatively high densities of associated lobsters and also their overall importance to the commercial lobster fishery over the past 13 years.

Experimental Design

Spiny and slipper lobster handling mortalities were estimated for two handling methods ("dry" and "wet"). The effects of on-deck exposure time on handling mortality were also estimated for spiny lobsters handled by the dry method. A particular combination of factors (method and exposure time) is called an experimental treatment. For dry treatments, lobsters were held on deck in 30-gallon containers without water and in direct sunlight for 1, 2, or 3 hours. In the wet treatment, lobsters were held on deck for 3 hours in shaded 30-gallon containers with circulating water. The 3-hour dry treatment is assumed to represent current commercial fishing practices, while

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[1]Under Amendment 9 of the Fisheries Management Plan for the Crustacean Fisheries of the Western Pacific Region (adopted in May 1996), all decked lobsters may be landed. Prior to Amendment 9, there was a prohibition on the landing of sublegal and berried lobsters. Established minimum legal sizes were 50 mm tail width for spiny lobster and 56 mm tail width for slipper lobster.

the 1- and 2-hour dry treatments and the 3-hour wet treatments represent possible handling alternatives or mitigative measures.

Spiny and slipper lobsters were collected using baited commercial lobster traps, sorted ("legal," "sublegal," and berried), and all sublegal and berried lobsters were held in circulating water tanks until a sufficiently large paired experimental treatment sample (N = 200) was collected. Initial experiments were between 3-hour wet and dry treatments followed by experiments involving 1-and 2-hour dry treatments. For each treatment, 100 lobsters were randomly chosen from the circulating water tank and placed into two 30-gallon treatment containers (dry or wet) at a density of 50 lobsters/container. After the designated exposure time (1, 2, or 3 hours), lobsters were removed from the treatment containers, their condition recorded as active (capable of tail flexion-swimming response), weak (incapable of tail flexion but able to move appendages when prodded), or dead, placed into lobster holding traps (commercial lobster traps with sealed entrances) at a density of five lobsters per trap, and held in two 1,320-gallon recirculating baitwells (21 gallons/minute) for 2 days. It was assumed that the 2-day holding period would allow ample time for the manifestation of any latent effects resulting from a treatment and that each lobster holding trap was a replicate (N = 20 replicates/treatment). Trap density within each baitwell was set at 20 traps. To provide a control for possible baitwell effects, five traps (controls) containing five lobsters each were placed in the baitwells (two traps in the port baitwell and three traps in the starboard baitwell) at the beginning of the holding phase. At the conclusion of the holding period, lobster conditions were again assessed for treated lobsters. The condition of lobsters in the control traps was recorded at the beginning and end of the holding phase.

Analytical Procedures

Handling mortality for each treatment was computed as the arithmetic mean of the percent mortality observed in the 20 treatment replicates. Randomization resampling was used to evaluate the precision of the handling mortality estimates. Approximate lower and upper 95% confidence limits for handling mortality were computed as the 2.5% and 97.5% percentiles of the bootstrap distributions using the computer program RT (Manly, 1994).

RESULTS

Spiny Lobster

Spiny lobster handling mortalities were estimated for the 1-, 2-, and 3-hour dry treatments and the 3-hour wet treatment. Spiny lobster condition (active, weak, or dead) tallies for each

treatment are shown in Table 1. All of the spiny lobsters subjected to the 3-hour wet treatment were active at the conclusion of the 2-day baitwell holding period. For the dry treatments, the number of active spiny lobsters decreased with increasing exposure time, while the number of dead lobsters increased with increasing exposure time. All control lobsters were active, implying no baitwell holding effects.

Dry treatment handling mortality ranged from 12% for the 1-hour treatment to 70% for the 3-hour treatment (Fig. 1). Pooling the tallies of dead and weak lobsters results in more conservative estimates of handling mortality, ranging from 16% for the 1-hour treatment to 77% for the 3-hour treatment (Fig. 2).

Slipper Lobster

Slipper lobster handling mortalities were only estimated for the 3-hour dry and wet treatments. Mechanical failure of the baitwell recirculating water pumps during the first 3-hour paired dry and wet experiments forced us to reduce the baitwell holding time to 1 day. After the baitwell pumps failed, we repeated the 3-hour dry treatment with a 1-day holding period, suspending the holding and control traps from the NOAA ship *Townsend Cromwell*, 10 feet below the sea surface.

Slipper lobster condition tallies (active, weak, or dead) for each treatment are shown in Table 2. In general, slipper lobsters subjected to the 3-hour wet treatment were active at the conclusion of the 1-day holding period. For the 3-hour dry treatment, the number of dead lobsters ranged from 14 to 39 while the number of active lobsters ranged from 56 to 83. All control lobsters were active, implying no baitwell holding effects.

Slipper lobster handling mortalities for the 3-hour dry treatment ranged from 14% to 39% with an average estimate of 27%. The more conservative estimates (weak and dead combined) of handling mortalities ranged from 17% to 44% with an average estimate of 31%. Handling mortality for the 3-hour wet treatment was 1%.

DISCUSSION

Handling mortality estimates reported in this document provide baseline estimates for assessing impacts due to handling effects of commercial lobster fishing operations. If the 3-hour dry experimental treatment represents current commercial fishing practices, then the handling mortality on commercial vessels would appear to be high, ranging from an average of 70% to 77% for spiny lobster, depending on how the data are pooled. The estimate of handling mortality for slipper lobster also appears to be excessive (31%) but is considerably less than spiny lobster

handling mortality estimates. This difference in handling mortalities between spiny and slipper lobsters suggests that spiny lobsters may have a lower "handling" tolerance than slipper lobsters. Handling mortality, however, represents only a portion of the total mortality resulting from the capture and discarding of lobster in the NWHI. Accounting for additional sources of mortality resulting from commercial fishing operations (e.g., predation) will likely result in total mortality estimates that approach 100%. Evidence suggests that discarded lobsters may be subject to high predation from *Caranx* spp., which aggregate around vessels during fishing operations (Gooding, 1982). Even if it is assumed that the 2-hour dry experimental treatment is more representative of fishing operations, handling mortality would still appear to be excessive. A possible alternative handling procedure for reducing total mortality would be to sort and discard lobsters immediately after they are decked. This practice appears to result in virtually no handling mortality.

REFERENCES

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Table 1. Spiny lobster tallies by condition for each treatment. The numbers in parentheses represent berried lobsters.

Treatment	Condition			Total
	Active	Weak	Dead	
1 hour dry	84 (15)	4 (0)	12 (1)	100 (16)
2 hour dry	55 (7)	20 (1)	25 (4)	100 (12)
3 hour dry	23 (4)	7 (2)	70 (7)	100 (13)
3 hour wet	100 (12)	0	0	100 (12)

Table 2. Slipper lobster tallies by condition for each treatment. The numbers in parentheses represent berried lobsters.

Treatment	Condition			Total
	Active	Weak	Dead	
3 hour dry	83 (5)	3 (5)	14 (3)	100 (13)
3 hour dry	56 (8)	5 (0)	39 (3)	100 (11)
3 hour wet	99 (19)	0	1 (0)	100 (19)

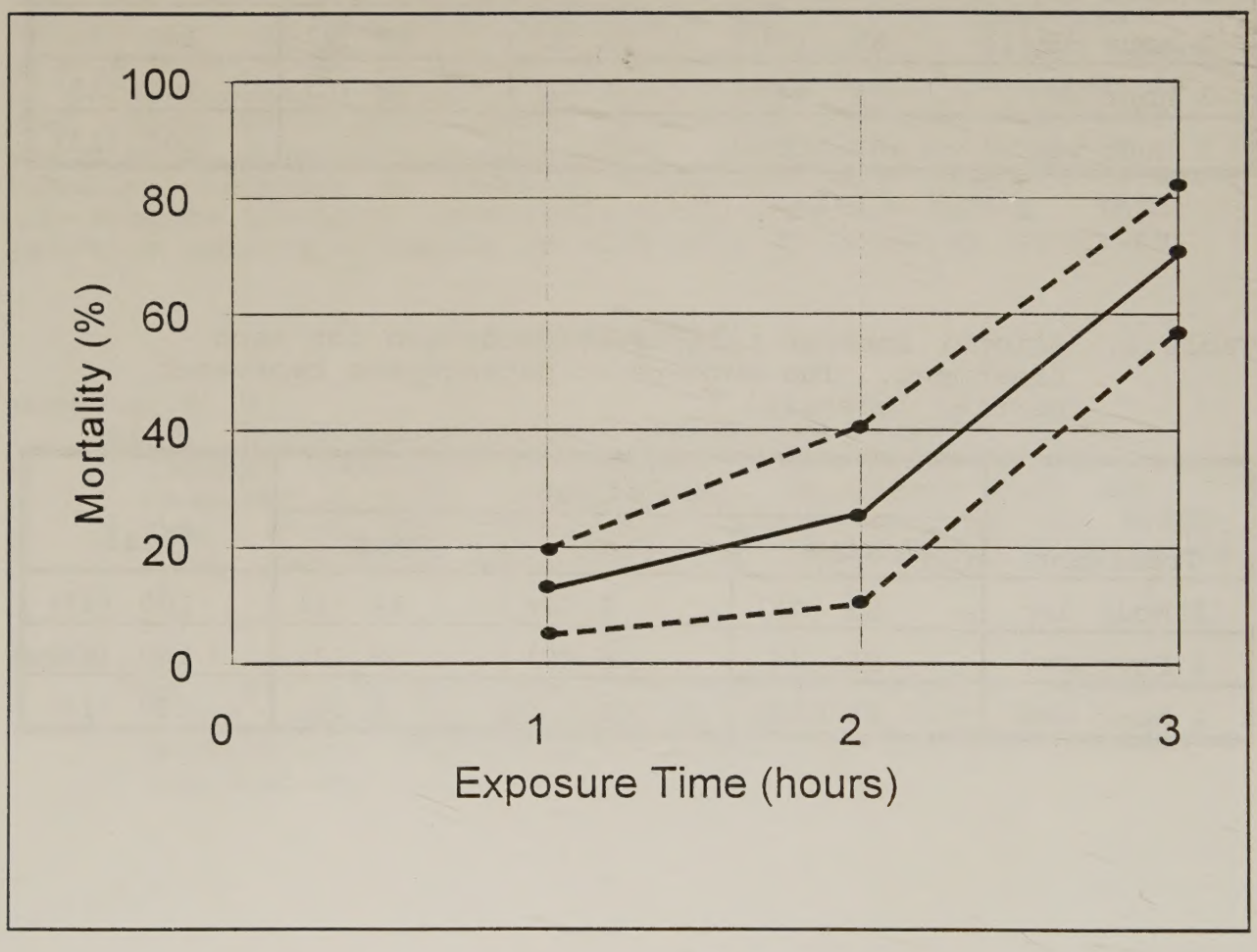

Figure 1. Spiny lobster handling mortality estimates for 1-, 2-, and 3-hour dry treatments. Dashed lines represent lower and upper 95% confidence interval.

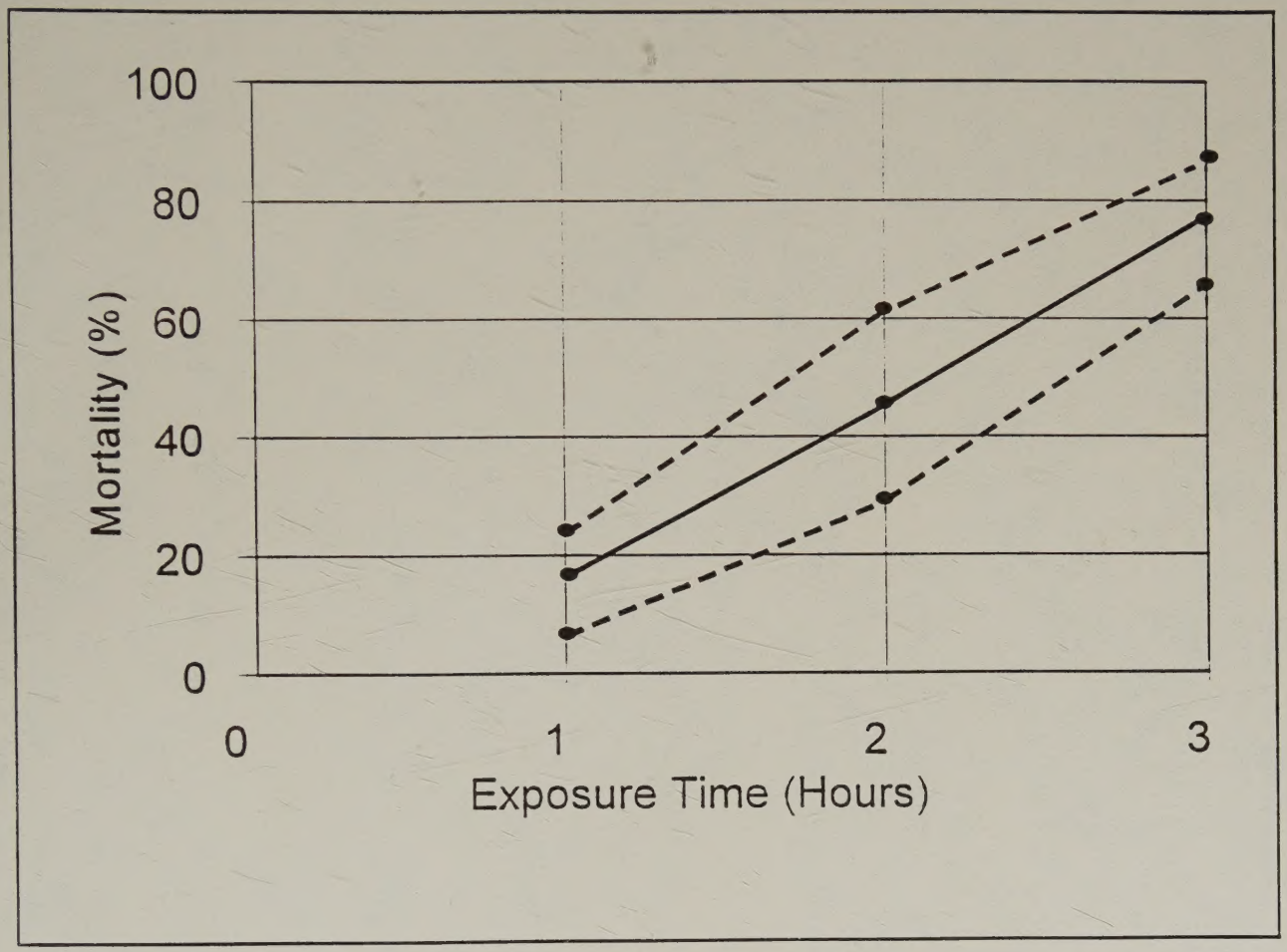

Figure 2. Pooled (dead and weak) spiny lobster handling mortality estimates for 1-, 2-, and 3-hour treatments. Dashed lines represent 95% confidence intervals.